

# Is Overfishing Triggering Marsh Die-off in Cape Cod Salt Marshes?

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## Abstract:

Salt marsh die-off, which is characterized by bare patches within formerly vegetated marsh areas, is a pervasive phenomenon found along salt marsh creek banks throughout Cape Cod, Massachusetts. Recent work has attributed the creation and maintenance of these die-off areas to the herbivorous marsh crab, *Sesarma reticulatum*. We suspect that *Sesarma*-driven marsh die-off is facilitated by proximity to human impacts, particularly overfishing, which has decreased predation pressure on local *Sesarma* populations. Along creek banks at 14 Cape Cod salt marshes we have quantified crab herbivory rates using caged and uncaged transplants of marsh cordgrass, measured *Sesarma* densities with pitfall traps, and assessed predation pressure on *Sesarma* by tethering caged and uncaged crabs to the marsh surface. High herbivory rates are correlated with high *Sesarma* densities and low predation pressure on *Sesarma*. We are currently trapping in marsh creeks for larger crabs and fish to determine whether the densities of predators on *Sesarma* (i.e. blue crabs, tautog) are affected by proximity to marinas and other aspects of human development.

## Introduction:

- Healthy salt marshes provide a variety of ecologically and economically valuable services
- Intense human development of marsh boundaries has had significant effects on marsh health
- *Sesarma reticulatum* is a nocturnal, herbivorous crab that has recently been linked with the die-off events in Cape Cod's salt marshes (Holdredge et al., 2009)



Figure 1: (left) The herbivorous marsh crab *Sesarma reticulatum*. (center) A salt marsh experiencing extensive creek bank die-off. (right) A healthy salt marsh with an intact creek bank cordgrass zone.

## Hypothesis:

- The decrease in *Sesarma* predators in recent years as a result of overfishing has triggered localized cordgrass die-off events in Cape Cod's salt marshes

## Methods:

- Experiments performed in 14 marshes throughout Cape Cod, MA, experiencing a range of die-off extent and exposure to human development
  - Caged and uncaged cordgrass transplants to quantify *Sesarma* herbivory
  - Pitfall trapping to measure *Sesarma* densities
  - Caged and uncaged *Sesarma* tethering to measure predation pressure
  - Trapping in creeks to quantify *Sesarma* predator densities

Figure 3: (left) Percentage of transplanted cordgrass stems grazed between highly developed and undeveloped marsh sites. (right) Number of *Sesarma* caught per pitfall trap between all developed and undeveloped sites.

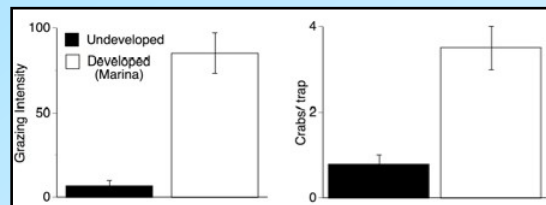


Figure 2: Map of high and low impact study sites on Cape Cod, MA.

## Results:

- High herbivory rates on cordgrass are correlated with high *Sesarma* densities, low predation pressure on *Sesarma* and lower numbers of *Sesarma* predators foraging in the marsh (e.g. blue crabs, tautog)
- *Sesarma* overgrazing appears to be amplified by proximity to marinas and other areas of high human impact

## Discussion:

- Human impacts on Cape Cod's salt marshes have triggered a top-down trophic cascade
  - **Overfishing → Decrease in *Sesarma* predators → Increase in *Sesarma* density → Increased cordgrass die-off**
- Development and overfishing have resulted in a loss of valuable ecosystem services, including:
  - Nursery grounds for commercially valuable fisheries
  - Nesting sites for rare and endangered bird species
  - Erosion prevention and resistance to storm damage

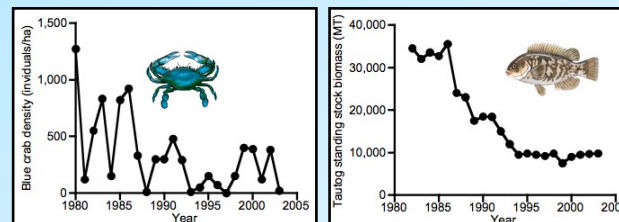


Figure 4: (left) The decline in blue crabs, an important *Sesarma* predator, over time is a result of overfishing. (right) The decline in tautog biomass over the last 30 years is also the result of overfishing (ASMFC, 2006).

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## References:

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- Holdredge, C., M. D. Bertness, and A. H. Altieri, 2009, Role of Crab Herbivory in Die-off of New England Salt Marshes, *Conservation Biology*, **23**: 672-679.